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Changes in the Structure of the Tennessee Dairy Industry

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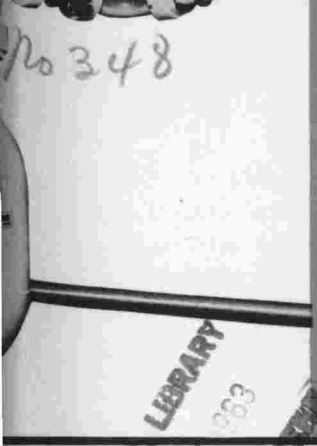

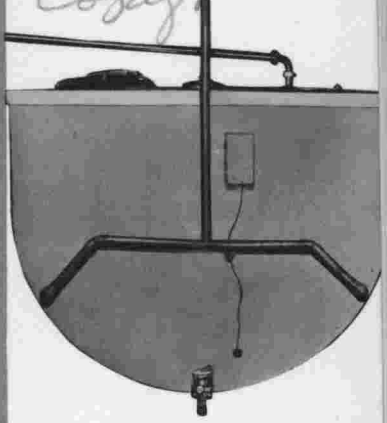

CHANGES IN THE STRUCTURE OF THE TENNESSEE DAIRY INDUSTRY

by Stanton P. Parry
Donna G. Greiner

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SUMMARY

SUBSTANTIAL changes have occurred in the dairy industry in the United States and in Tennessee during the 1950's. This bulletin was written to show where the industry has been and to suggest where it might be headed in order to aid decision-making by dairy firms at the production and marketing levels.

- At the production level, a shift has been evident toward concentration of commercial dairying. The number of farms reporting milk cows declined 43% in Tennessee from 1950 to 1959.

- The average size of the dairy herd has increased and average production per cow in the United States has risen to 7,211 pounds in 1961; this is 36% greater than the 1949-51 average.

- In Tennessee output per cow is 29% over the 1949-51 level. Farmers are able to care for more milk cows because of the increased use of equipment, such as bulk tanks, milking parlors, pipe line milkers, and through the use of many types of labor-conserving field equipment.

- In Tennessee, a slightly higher proportion of the total farm receipts has come from dairying than in the United States. For the 1949-61 period, this averaged close to 15%.

- The number of processing plants in the United States has decreased, but the average value of their shipments is up 52% since 1954. A similar decline in plant numbers with increased volume per plant was noted also in Tennessee. Nationwide, a greater proportion of the market is being taken by large dairy processors.

- In Tennessee, the proportion of the total milk supply for human consumption used for manufactured dairy products averaged 56%, with 44% being used as fluid milk and cream items during the decade of the fifties. The manufacture of ice cream, cheese, and evaporated milk was increasing in Tennessee. A larger percentage of the milk was delivered to plants and dealers regulated by Federal orders. The average price of both manufactured and fluid grade milk has been relatively steady except for the increase during the Korean War period, 1951-52.

- Per capita consumption of milk and milk products in the United States decreased from 769 pounds in 1947 to 642 pounds in 1961. Despite a growing population, total civilian consumption from commercial sources showed a decline in 1961.

- **Important shifts at the consumption level in both the United States and Tennessee have influenced percent of producer milk used for fluid purposes, type of fluid product sold, container size, and method of distribution.**

- **These trends are expected to continue with the necessary economic adjustments being made by the dairy industry.**

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Changes in the Structure of the Tennessee Dairy Industry

by
Stanton P. Parry
and
Donna G. Greiner [1]

INTRODUCTION

Dairy Industry Changes

THE dairy industry has changed substantially during the past decade. Technological innovations and methodological changes have occurred at both the production and marketing levels. The purpose of this report is to review these shifts and to consider some of the economic implications of such changes to the Tennessee dairy industry.

Some of the more important changes at the dairy farm level are increased farm size, both in acres and in number of milk cows; reduced number of total milk cows on Tennessee farms; increased production per cow; increased shipment per producer; and greater use of labor-saving devices, such as bulk milk tanks and pipeline milkers. At the plant level, there are fewer manufacturing and fluid milk plants in Tennessee with a greater volume of milk handled per plant.

Some of the more important milk distribution and consumption trends include: a growing total population with a declining farm

[1] Assistant Professor and Assistant in Agricultural Economics, respectively.

population; a reduction in the per capita demand for milk, and in 1961 a decline in total civilian consumption from commercial sources; the use of less milk fat and more nonfat-solids; changes in the price and supply of dairy products and products that compete with them; greater government activity in milk marketing; and finally, changes in types of packaging and methods of distributing dairy products.

FARM LEVEL CHANGES

Dairy Farm Size

Tennessee farms with milk cows declined from 153,952 farms in 1950 to 88,137 in 1959,[2] a decline of 43% between these two census periods. However, even in 1959 a larger proportion, or almost 54% of these, were farms reporting only 1 or 2 milk cows. At the other extreme, 0.9% of the farms reported 50 or more milk cows, up from the 0.3% reporting 50 or more in 1950. Figure 1 shows the change between 1950 and 1959 in Tennessee farms with milk cows. Tennessee farm herd size is expected to continue to increase in the decade ahead, while the decline in the number of farms reporting milk cows will continue as commercial dairying becomes more concentrated.

Data available for Tennessee from the 1959 census give some indication of the labor efficiency obtained by larger-size units.[3] For example, dairy farms selling farm products valued at $10,000 or more averaged 20 or more milk cows per full-time worker. Those with sales of $5,000 to $9,999 averaged 18 cows per worker; farms with sales of $2,500 to $4,999 averaged 12 cows per worker; while those with less than $2,500 sales had only 6 cows per worker. Underutilization of labor, as measured by these limited aggregate figures, would indicate the need for larger-size dairy units. All commercial dairy farms in Tennessee averaged 16 milk cows per full time worker.

Dairy Farm Output

Two of the most noticeable changes in dairy-farm characteristics during the fifties were 1) the increase in production of milk per cow, and 2) the drastic decline in the number of milk cows. Since 1949-51 the number of milk cows in the United States has dropped over 20%, while average annual production per cow has risen 36%.

For the United States, the 1949-51 average production was 5,306

[2] See Appendix Table 1.
[3] See Appendix Table 4.

pounds per cow; in 1961 this was up to 7,211 pounds. In Tennessee, the number of milk cows in 1961 was down over 21% from the

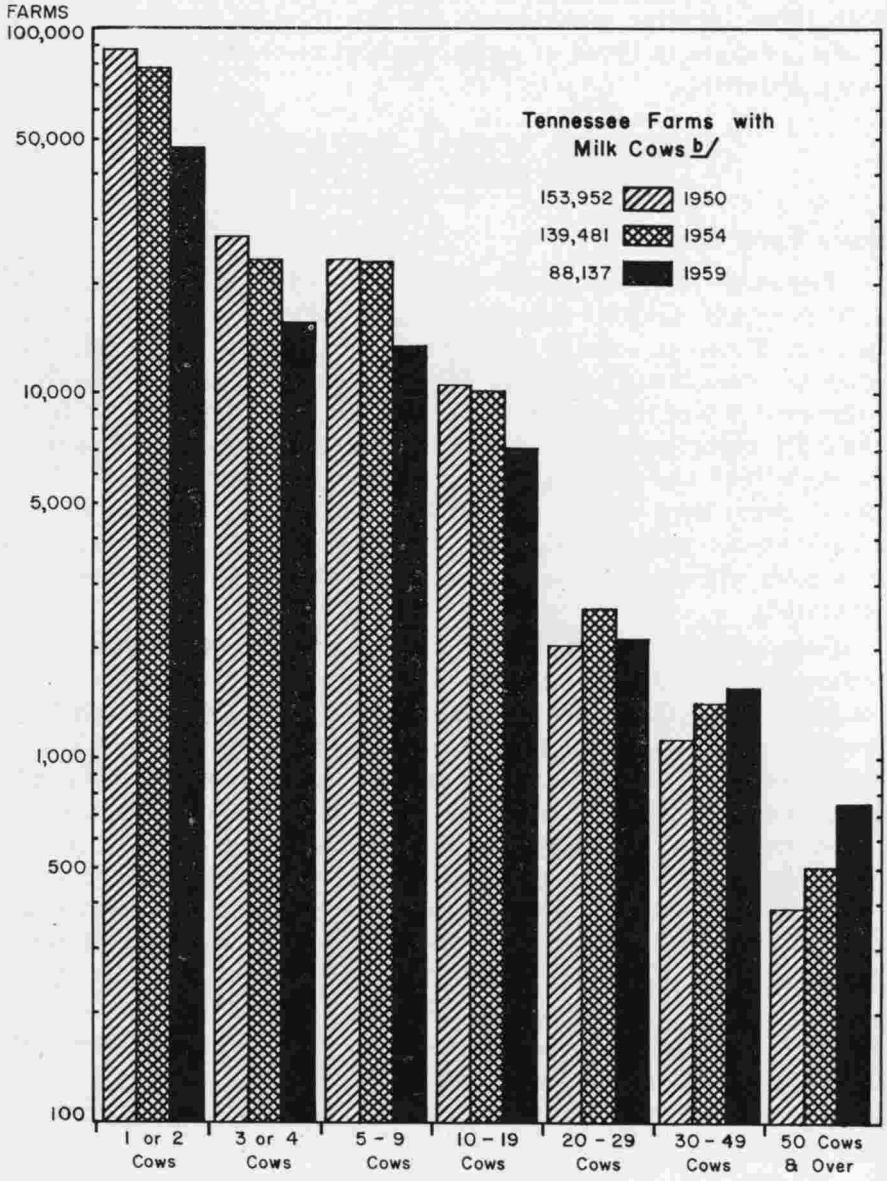
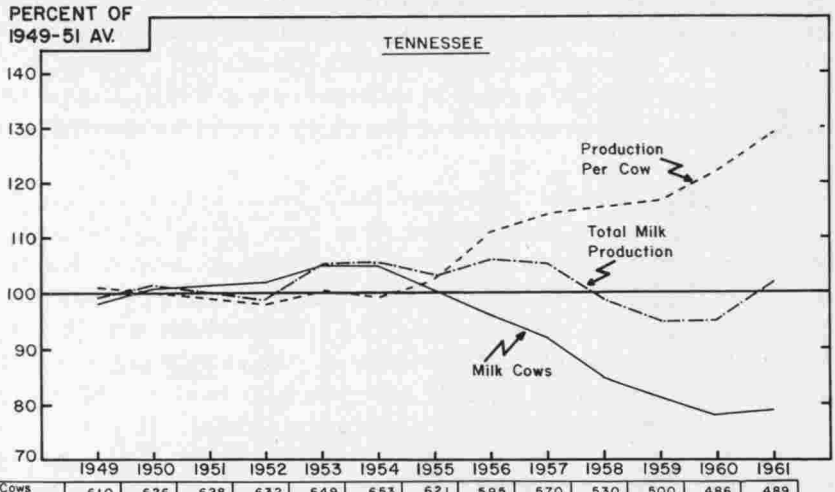


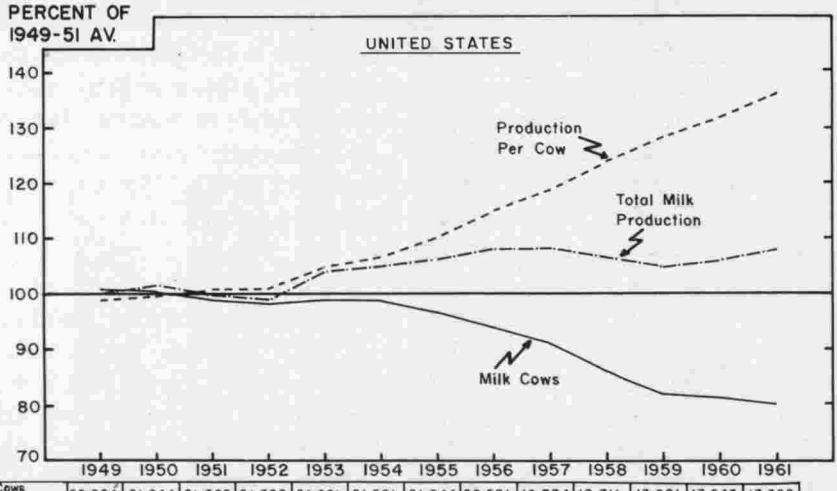
Figure 1. Changes in number of farms reporting milk cows by size of herd, Tennessee 1950, 1954, and 1959.[a]

[a] U. S. Census of Agriculture (see Appendix Table 1).

[b] Note that the vertical scale is a logarithmic scale. This allows comparison of percentage changes between years.



	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
Milk Cows (Thous.)	610	626	628	632	649	653	621	595	570	530	500	486	489
Production (Mil. Lb.)	2,288	2,329	2,311	2,294	2,421	2,416	2,372	2,445	2,422	2,279	2,200	2,202	2,347
Production Per Cow (Lb.)	3,750	3,720	3,680	3,630	3,730	3,700	3,820	4,110	4,250	4,300	4,400	4,530	4,800



	1949	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960	1961
Milk Cows (Thous.)	22,024	21,944	21,505	21,338	21,691	21,581	21,044	20,501	19,774	18,711	17,901	17,543	17,398
Production (Mil. Lb.)	116,103	116,602	114,681	114,671	120,221	122,094	122,945	124,860	124,628	123,220	121,989	122,803	125,456
Production Per Cow (Lb.)	5,272	5,314	5,333	5,374	5,542	5,657	5,842	6,090	6,303	6,585	6,815	7,000	7,211

Figure 2. Relative changes in milk cows, production per cow, and total milk production, United States and Tennessee, 1949-1961.[a]

[a] Statistical Bulletin No. 289, U. S. Department of Agriculture, June 1961 and **Milk Production**, Da 1-1 (2-62) U. S. Department of Agriculture, February 13, 1962.

1949-51 average, and output per cow was up 29% or from 3,717 to 4,800 pounds (Fig. 2). In 1961, the average production per cow was over 10,000 pounds in California, the highest in the nation. Thirteen

other states recorded average production of over 8,000 pounds. Some of the better dairy farmers in Tennessee are doing as well. For example, Dairy Herd Improvement Association farmers in Tennessee averaged 8,420 pounds of milk per cow in 1961. The potential for expanding the production of the dairy cow in Tennessee is very great.

Back of the present advances have been: better feeding practices, higher quality feed, better sires from artificial breeding, use of many labor-saving devices, and better management of the fewer but larger dairy farms. These resolve themselves into what might be called the feed conversion stage of milk production with part of the increase due to greater efficiency of the cow brought about by artificial breeding and natural selection and part of the increase from putting more feed through the same animal.

Dairy Farm Equipment

The adoption of expensive labor-saving equipment has been an important factor in increasing herd size. One of the most dramatic examples is found in the shift from cans to bulk tanks on the farm. In 1956, the five principal Tennessee fluid milk markets had less than 10% of their milk receipts from producers having bulk milk tanks.[4] By January 1, 1962, all five markets were approaching 100% conversion to bulk tank shipment (Fig. 3). The use of tank trucks required in conjunction with these farm tanks has greatly widened the supply area for plants.

Other equipment changes on Tennessee dairy farms during the decade of the fifties include: a 245% increase in the number of farms reporting pick-up hay balers; a 426% increase in dairy farms owning corn pickers; a 21% increase in dairy farms with motor trucks; a 33% increase in the number of tractor-owning dairy farms; and a 68% increase in the number of farms with milking machines (see Appendix Table 6). These equipment increases occurred while the number of dairy farms dropped by 34% in Tennessee.

Farm Cash Receipts From Dairy Product Sales

The percent of total cash receipts from dairy farm marketings has been relatively steady in the United States over the past decade with a slight upward trend noted for Tennessee. In the United States, cash receipts from dairy products as a percentage of all

[4] The five principal fluid milk markets in Tennessee include the areas regulated under the Appalachian (includes Bluefield data except as noted), Chattanooga, Knoxville, Memphis, and Nashville Federal milk orders.

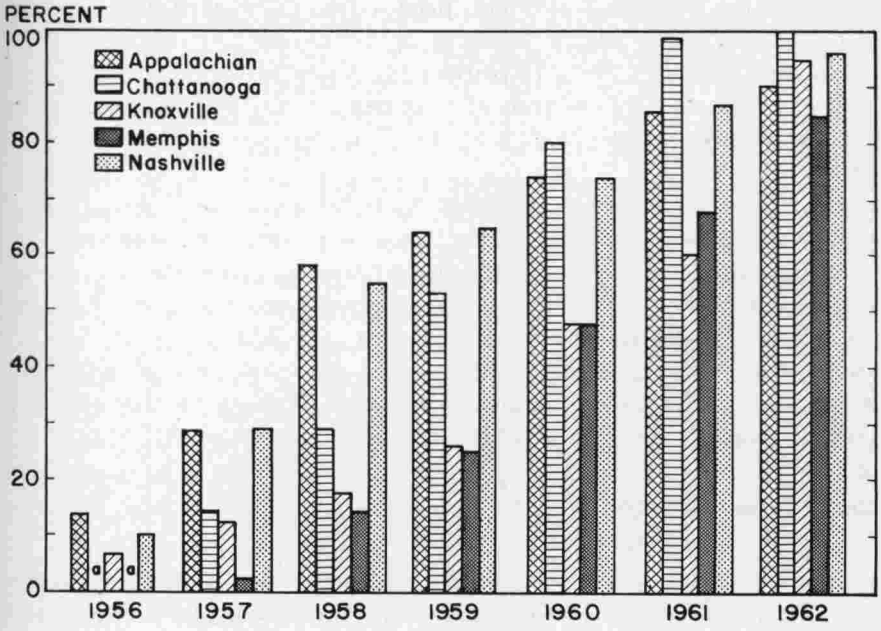


Figure 3. Milk receipts from producers having bulk tanks as a percentage of total producer receipts, five Tennessee Federal order markets, 1956-1962.[b]

[a] 1956 data not available for Chattanooga or Memphis Markets.

[b] January 1, data each year from market administrators reports and AMS-261, U. S. Department of Agriculture, July 1961.

farm commodities ranged from 13% to 15.6% during the 1949-1961 period. In Tennessee, a slightly higher proportion of total farm receipts has come from dairying than for the nation as a whole (Fig. 4). This proportion ranged from 13.5% to an estimated 17% over the 1949-1961 period.

Combined marketings of milk and cream from Tennessee farms brought cash receipts of $85.9 million in 1961, a new high—and 9% above 1960. The high cash receipts for dairy products were due to record sales of milk to plants and dealers. The 1,955 million pounds of milk sold to plants and dealers exceeded the previous high set in 1957 by 9%. The other two components of dairy cash receipts, sales of cream to plants and dealers and milk retailed by farmers, both continued their long-run decline. In 1961, only 0.2% of total milk produced in Tennessee was sold as farm-separated cream compared to 6% in 1950. In 1961, only 1% of milk produced was retailed by farmers; in 1950 this figure was over 3%. These

relative and quantitative changes for the United States and for Tennessee may be noted in Figure 5.

This chart also shows that whole milk sold to plants and dealers now accounts for 85% of Tennessee production compared to 55% in 1950. In 1950, 36% of all milk produced was used on farms—either fed to calves, consumed as fluid milk or cream by the farm family, or used for farm-churned butter. This reduced usage on farms in Tennessee amounted to over 0.5 billion pounds between 1950 and 1961. For the United States, the reduction amounted to about 10 billion pounds. This reduction in farm use made more milk available for commercial channels without an increase in actual production. A reduction of similar magnitude cannot occur in the future since the total amount consumed on farms totaled only 8.4 billion pounds in 1961. Fewer milk cows and therefore fewer replacements raised, milk substitutes fed to calves, and especially the reduced farm population: all have contributed to these changes in the amount of milk used on farms.

Figure 6 shows the change in percent of total cash receipts obtained from dairy product sales by counties in Tennessee from 1949 to 1959. In 1949, the counties with a high proportion (over 30%)

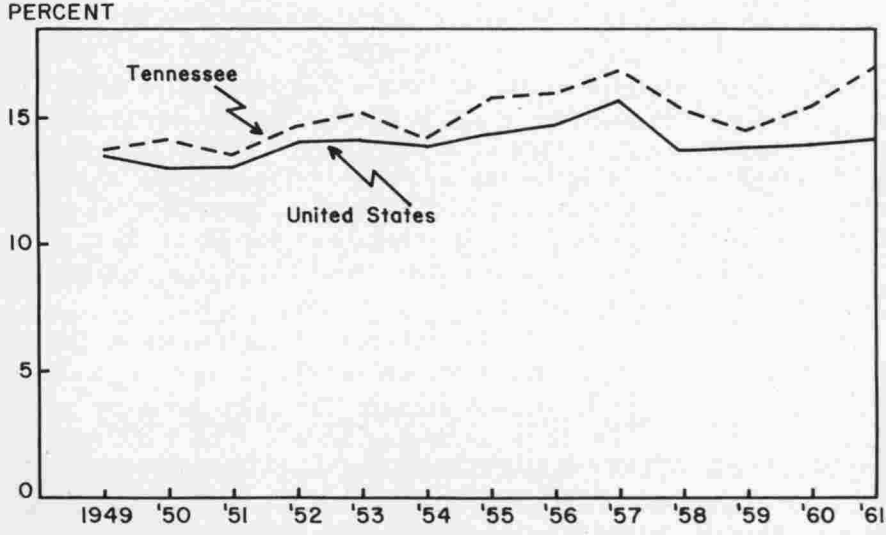


Figure 4. Dairy products cash receipts as a percentage of total cash receipts by farmers, Tennessee and U. S., 1949-1961.[a]

[a] Statistical Bulletin 262, April 1960; **Farm Income Situation** (FIS-183 Supplement, August 1961; FIS 185, March 1962), and **Milk Production, Disposition, and Income 1960-1961,** Da-2(62), April 1962, all by U. S. Department of Agriculture.

of their cash receipts from dairy included: Marshall 44%, McMinn 42%, Bradley 38%, Rutherford 37%, Davidson 33%, Bedford 32%, Giles 32%, Knox 32%. In 1959, Davidson, Bedford, Giles, Bradley,

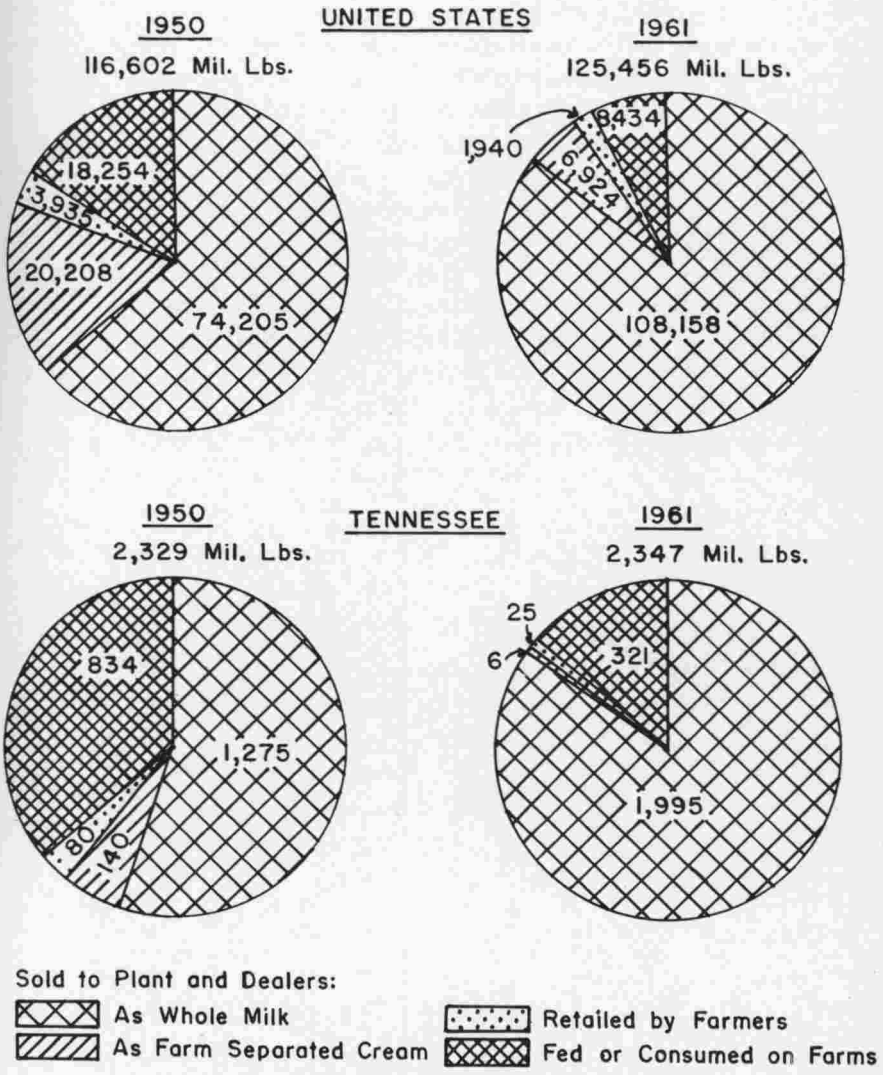
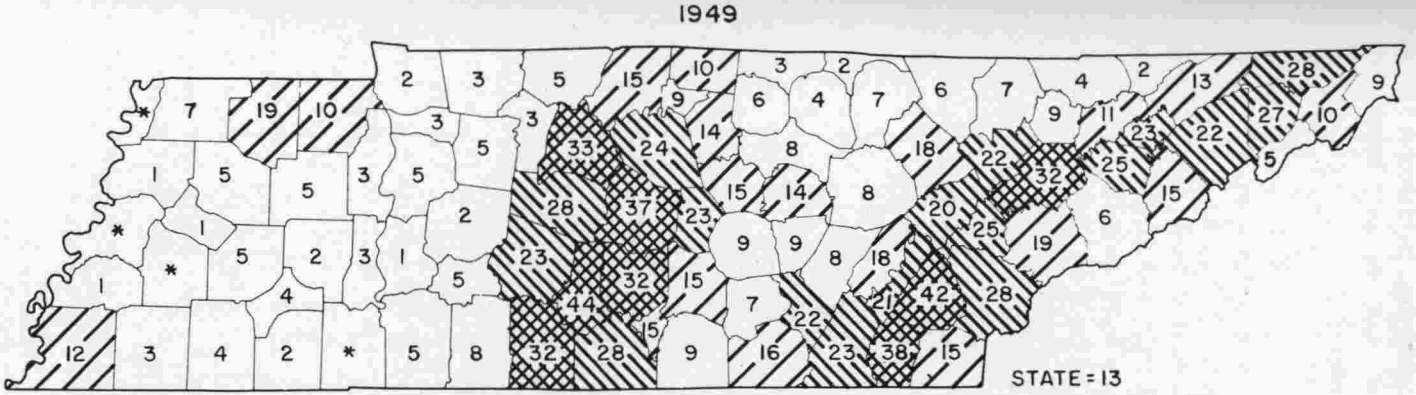
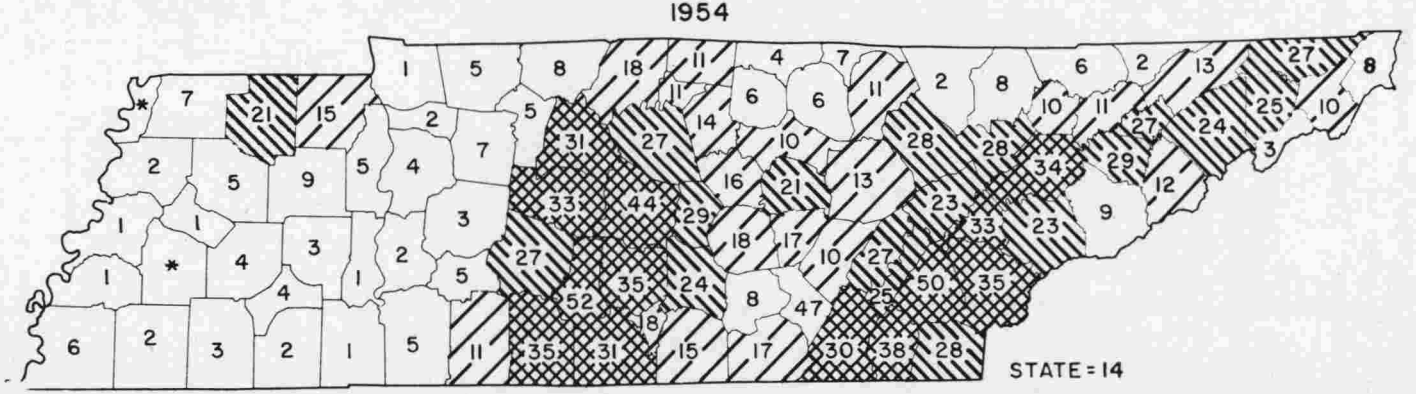


Figure 5. Disposition of total milk production, United States and Tennessee, 1950 and 1961.[a]

[a] Statistical Bulletin No. 303, ERS, U. S. Department of Agriculture, February 1962, and **Milk Production**, Tennessee Crop Reporting Service, May 1962.

and Knox were no longer on this list. Monroe, Sequatchie, Loudon, and Sullivan were added to the list of counties with over 30% of cash receipts from sales of dairy products.


1949
STATE = 13


1954
STATE = 14

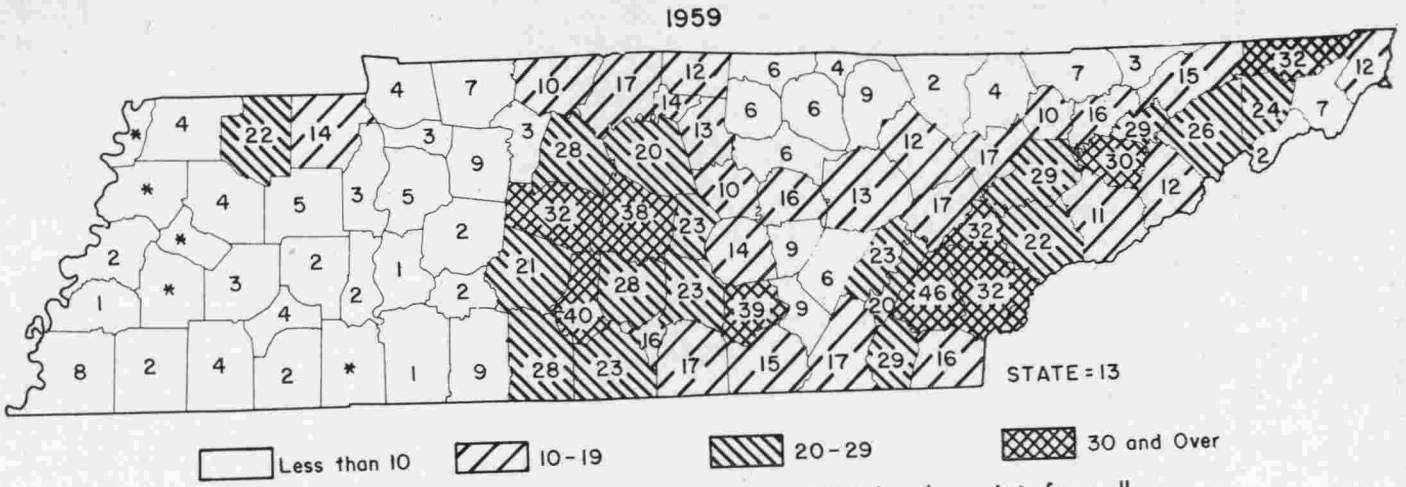


Figure 6. Dairy cash receipts as a percentage of total cash receipts from all farm commodity sales by county, Tennessee, 1949, 1954, and 1959.[a]

a Source: U. S. Census of Agriculture, 1950, 1954, and 1959.

PLANT CHANGES

Number of Plants

1958 Census of Manufactures shows 5,817 plants in the United States which are primarily engaged in processing and distributing fluid milk and cream.[5] This represents a 13% decrease from the 6,689 fluid milk plants reported in 1954. Over the same period, the value of shipments per plant increased from $727,330 to $1,106,457, up 52%. The average number of employees per plant increased from 28 to 36. In Tennessee, the number of fluid milk plants declined by 10% between 1954 and 1958, or from 91 to 82. Sales per plant meanwhile increased from $770,165 to $1,027,683, up 33%. Decreases were also noted in the number of condensed milk and evaporated milk plants, specialty dairy plants, and cheese plants in Tennessee (Appendix Table 5).

Size of Plant

Another significant factor in the structure of the dairy industry was the increasing share of the market obtained by large dairy processors. In 1950, the four largest dairy firms in the United States had 29.3% of the market. By 1957, the market share obtained by the four largest dairy firms accounted for 34.1% of the $9.2 billion in total sales by dairy processors.[6] The eight largest firms held 43.8% of the total market share in 1957 compared to 38.1% in 1950.

Federal order data for five Tennessee milk markets provide further evidence of growth in fluid milk plant size. The class I or fluid sales per handler in each major market have shown an upward trend (Fig. 7). Nashville provides an exception for 1960 to 1961, because regulation was then extended to several small handlers when 14 new counties were added to that order area on November 1, 1960.

Products Processed

The proportion of the Tennessee milk supply for human consumption was divided about 44% fluid and 56% manufactured over the period 1950-1961.[7] Figure 8 shows the use of milk for manu-

[5] Census of Manufacturers, 1958 MC (2)-20B, Dairy Products, U. S.Department of Commerce, 1960.

[6] Small Business Problems in the Dairy Industry, Report of the Select Committee on Small Business, House of Representatives, 86th Congress, 2nd Session, House Report No. 2231, Dec. 22, 1960, p. 11.

[7] Supply for human consumption refers to total production less that fed to calves. Manufactured use includes milk equivalent manufactured in plants plus farm churned butter. The residual is fluid use, farm and nonfarm.

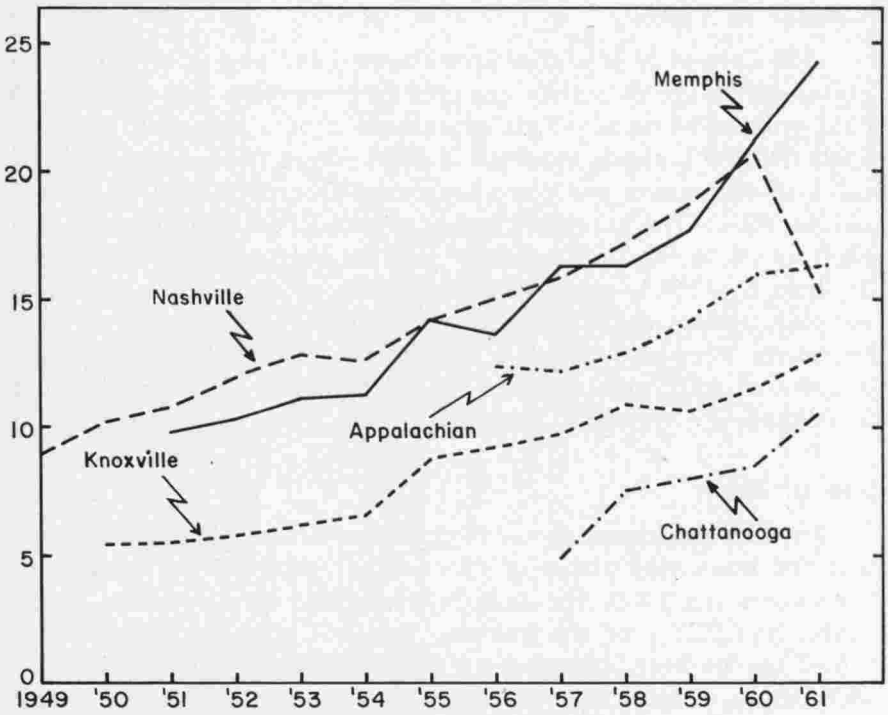


Figure 7. Change in quantity of Class I sales of producer milk per handler, five Tennessee Markets, 1949-61.[a]

[a] Source: Market administrators reports: Data based on first full year each market was under Federal Milk Order regulation. Annual Class I sales of producer milk divided by number of regulated handlers as of December each year except where substantial change in area regulated during the year as in Knoxville December 1, 1954 and Nashville November 1, 1960. In these cases handler numbers in month prior to change were used.

factured products by plants in Tennessee. Creamery butter production declined slightly over the decade of the fifties. American cheese production has been somewhat erratic over the same period, with large increases recorded in 1953 and 1957. The milk equivalent used in American cheese stood at 322 million pounds in 1960. Other types of cheese have shown a steady increase since 1949. Milk equivalent used in cheese production other than American type was up approximately 50 million pounds in 1960 over the average for 1949-51.

Evaporated milk production has increased in Tennessee over the early 1950's. This is in contrast to the United States trend

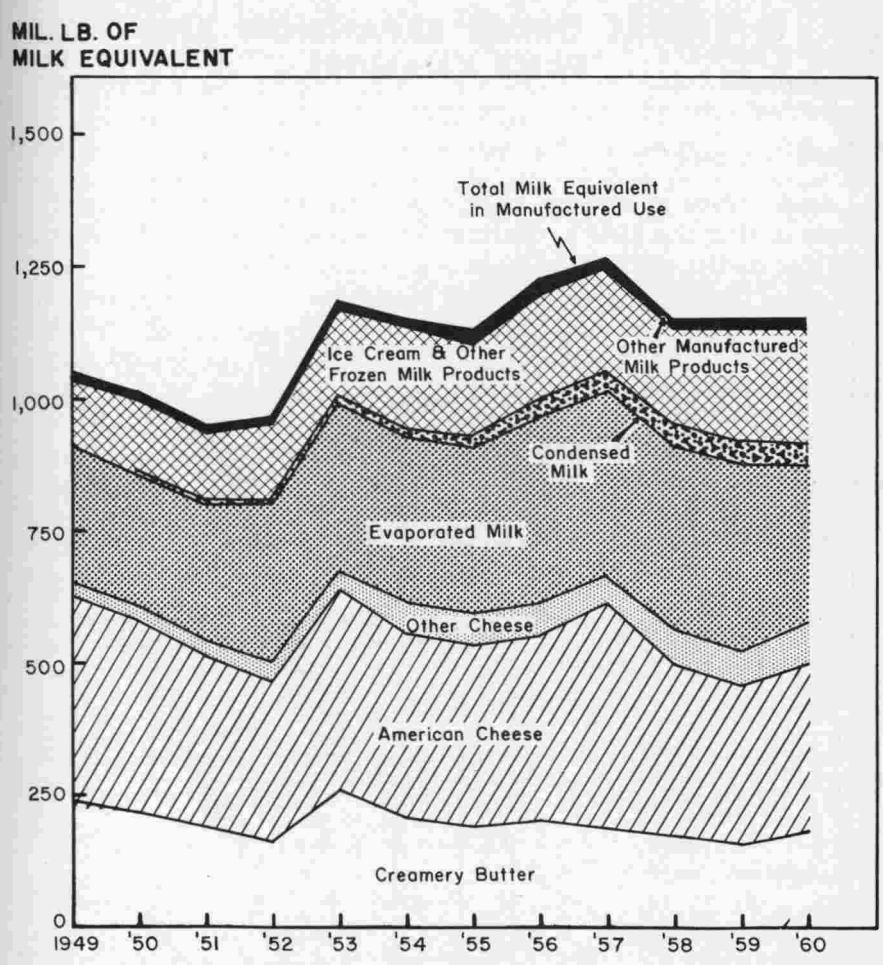


Figure 8. Whole milk equivalent used in the production of selected dairy manufactured products, Tennessee, 1949-1960.[a]

[a] Statistical Bulletin 303, ERS, U. S. Department of Agriculture, February 1962.

which has shown a decline in evaporated milk production every year except one since 1951. United States milk usage of evaporated milk in 1960 was 1¾ billion pounds less than for the average of 1949-1951. In Tennessee, condensed milk and frozen milk products also showed an increase over the early 1950's.

FEDERAL ORDER EXPANSION AND PRICE CHANGES

Federal Orders

An increase in Federal milk order regulation occurred in Tennessee during the 1950's. During this period Federal order regulation was instituted in the Chattanooga and the Appalachian (Bristol) area. Both the Memphis and Nashville orders had substantial extension of their market areas during this same period. In 1956, about 35% of all Tennessee milk delivered to plants and dealers was delivered to Federal order plants. By 1961, this had increased to over 40% (Fig. 9).[8]

Prices

Prices received by farmers for all milk and for manufacturing grade milk held relatively steady during the decade except for the

[8] For more detail on the operation of Federal orders in Tennessee see "Marketing Milk Under Federal Orders in Tennessee," by S. P. Parry, **Tennessee Farm and Home Science**, Progress Report 41, January, February, March, 1962.

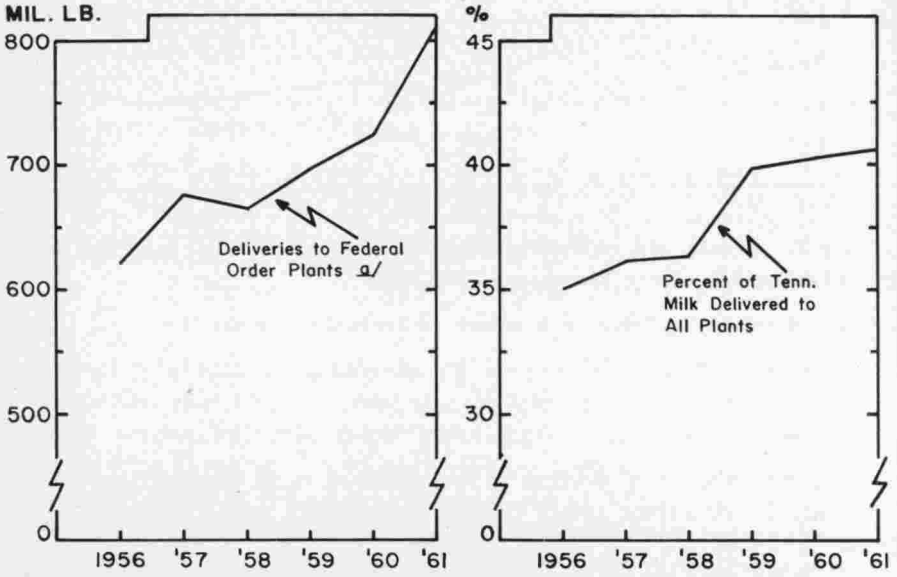


Figure 9. Total deliveries to Federal Order Plants and as a percentage of deliveries to all plants, Tennessee, 1956-1961.[a]

[a] Total deliveries of milk by Tennessee producers to handlers regulated under Federal milk orders. Statistical Bulletin No. 248, U. S. Department of Agriculture, **Federal Milk Order Statistics 1947-56** and Supplements. 1961 data are preliminary.

years 1951 and 1952 (Fig. 10). The increased milk price in 1951 and 1952 was in response to an increase in demand associated with the Korean War. These higher prices together with a sharp decline in beef cattle prices were partly responsible for the record 5½ billion-pound increase in United States milk production in 1953. For Tennessee, 1953 milk production was 127 million pounds over 1952 for the largest annual increase of the decade until the 1961 production year (Fig. 2).

As a result of the wide imbalance between supply and demand, the support level for prices of manufacturing milk were lowered in April, 1953, from $3.74 per hundredweight to $3.15. Both manufacturing prices and fluid grade prices in Tennessee, which are tied to manufacturing by formula in the principal milk markets of the State, declined—thus reflecting this lowered support level. In Tennessee, milk for fluid use was priced about $1.49 per hundredweight over manufacturing grade milk for the period 1953 through 1961. There was a slight increase in manufacturing grade milk prices between 1959 and 1960 and between 1960 and 1961 in response to an increase in the support level from $3.06 to $3.22 in September,

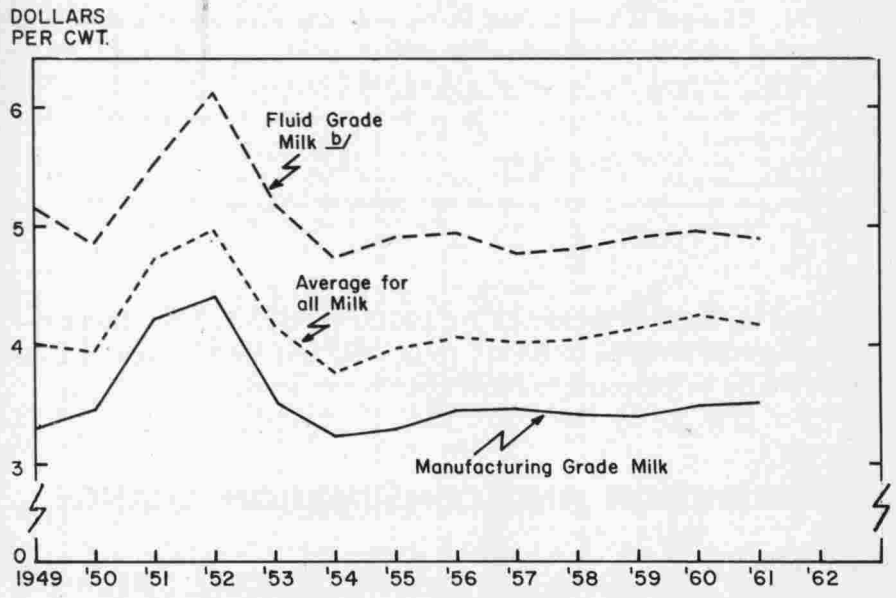


Figure 10. Prices received by Tennessee Farmers for all whole milk, manufacturing grade milk, and fluid grade milk, annual average 1949-1961.[a]

[a] Statistical Bulletin 303, ERS, U. S. Department of Agriculture, February 1962, and **Agricultural Prices**, SRS, U. S. Department of Agriculture, April 15, 1962.

[b] Milk eligible for fluid market including surplus.

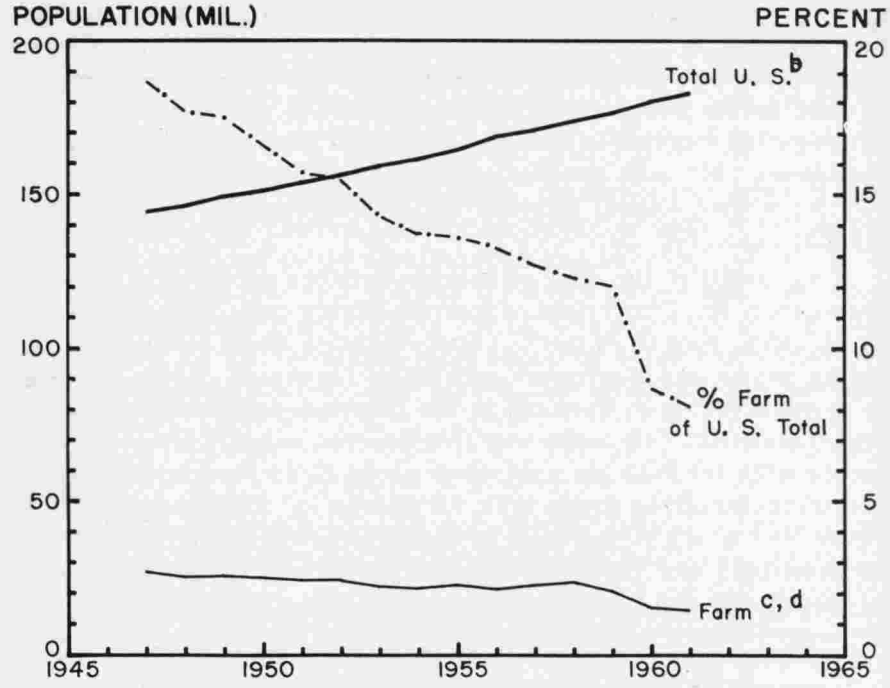


Figure 11. Changes in total United States and farm population[a] and farm as a percent of total, United States, 1947-1961.

[a] Source: Statistical Abstract of the United States, 1961, p. 5 and p. 613; and Bureau of Census, p. 25, No. 245, March 16, 1962, and p. 27, No. 31, March 14, 1962; 1960 and 1961 data include Alaska and Hawaii.

[b] July 1 data 1947-50; 1951-61 data April 1.

[c] As of April 1 each year.

[d] New census definition of farm used for 1960-61 farm population estimates (see footnote Appendix Table 2 for definition of farm).

1960, and up to $3.40 on March 10, 1961. On April 1, 1962, this support price was lowered to $3.11; thus 1962 and later prices in Tennessee would be expected to reflect this lower level.

DISTRIBUTION AND CONSUMPTION CHANGE

Population

One outstanding population change in the United States since the end of World War II has been the decline in farm population relative to total population. While U. S. population increased by almost 40 million persons between 1947 and 1961, farm population dropped by over 12 million. Farm population as a percent of total

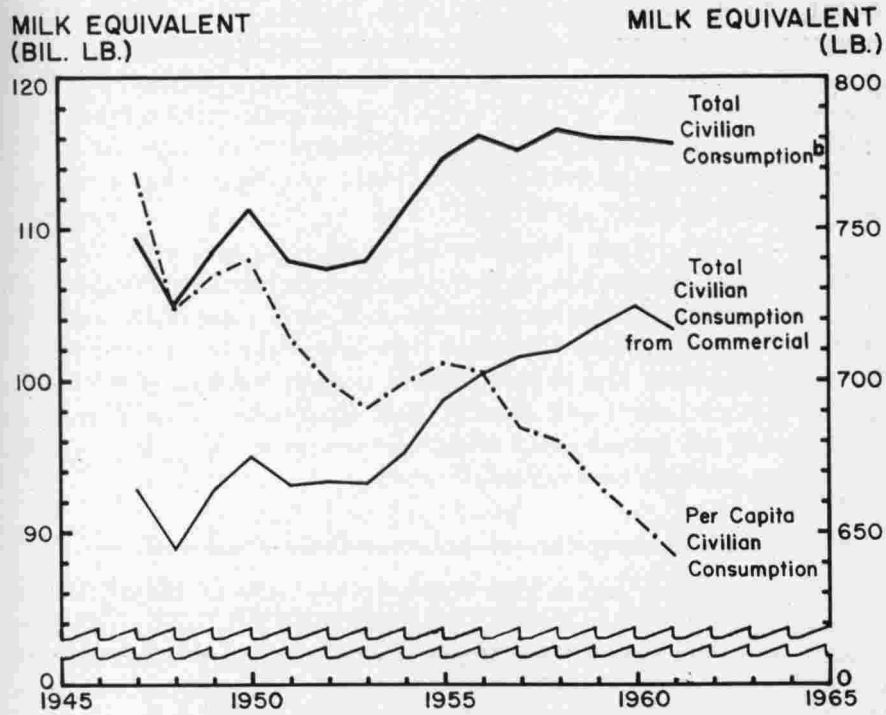


Figure 12. Changes in total civilian milk consumption, civilian consumption from commercial sources and per capita consumption, United States, 1947-61.[a]

[a] Source: DS 286, U. S. Department of Agriculture, November 1961, p. 41.

[b] Includes civilian consumption from commercial sources, National School Lunch and Special Milk Programs, Commodity Credit Corporation supplies to civilian channels, and milk and butter consumed in households on milk-producing farms.

population declined from 18.7% in 1947 to only 8.1% in 1961. These trends may be noted in Figure 11. Reduced farm population is one of the factors contributing to changing milk consumption patterns since farm families consume differently than the nonfarm population.[9]

Aggregate Milk Consumption Patterns

Because of a shifting population and changes in food consumption habits within that population, milk consumption patterns for

[9] A detailed survey of food consumption habits of Americans showed rural farm families in the United States consumed 17 quarts of fresh fluid milk per week compared to urban consumption of 10 quarts. In the South this difference was even larger—rural farm families consumed an average of 17 quarts per week compared to only 8 quarts for urban families. Household Food Consumption Survey 1955, U. S. Dept. of Agriculture—Report No. 1, pp. 40 and 44 and Report No. 4, pp. 40 and 44.

civilians have changed radically in the decade of the fifties. While total milk and milk product consumption by civilians is up over immediate postwar levels, per capita civilian consumption has been decreasing steadily. In 1961, total civilian consumption from commercial sources actually declined for the first time since 1950 with dropping per capita consumption rates overbalancing a rapidly expanding population (Fig. 12).

Per capita civilian consumption of all milk and milk products which was at 769 pounds in 1947 was only an estimated 642 pounds in 1961. Of this latter figure, 33 pounds were consumed on farms with milk cows, 22 pounds were from government distribution of supplies of butter and cheese, and 14 pounds were supplied in National School Lunch and Special Milk Programs. Therefore, only 573 pounds per person came from commercial sources. In 1947, 651 pounds came from commercial sources.

Per Capita Consumption of Selected Milk Products

Changes in per capita milk consumption rates by major product category are shown in Table 1. In 1961 fluid milk and cream consumption levels were 88% of the 1947-49 average; evaporated milk was only 59% of its immediate postwar consumption level, and butter 70%. On the other hand, cheese except cottage was up 21% over the 1947-49 level, nonfat dry milk was up almost 100%, cottage cheese increased by 68% and margarine, a major dairy competitor, by 70% during the same period.

Table 1. Civilian Per Capita Consumption of Selected Dairy Products and Margarine, 1935-1961.[a]

	Average 1935-39	Average 1947-49	1958	1959	1960[b]	1961[b]	1961 as a percent of 1935-39	1961 as a percent of 1947-49
	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Pct.	Pct.
Fluid milk & cream	330	359	336	330	324	314	95	88
Cheese, except cottage cheese	5.6	7.0	8.2	8.1	8.4	8.5	152	121
Evaporated milk	15.1	18.1	12.3	11.9	11.3	10.7	71	59
Ice cream	9.9	18.7	17.8	18.7	18.4	18.1	183	97
Nonfat dry milk	1.9	3.2	5.6	6.2	6.2	6.2	326	194
Butter	17.0	10.6	8.3	7.9	7.5	7.4	44	70
Margarine	2.9	5.6	9.0	9.2	9.4	9.5	328	170
Cottage Cheese	1.5	2.8	4.6	4.7	4.8	4.7	313	168

[a] Source: U. S. Department of Agriculture publications as follows: Statistical Bulletin No. 303, February, 1962; DS-290, June, 1962, and National Food Situation, NFS-99, February, 1962.
[b] Preliminary.

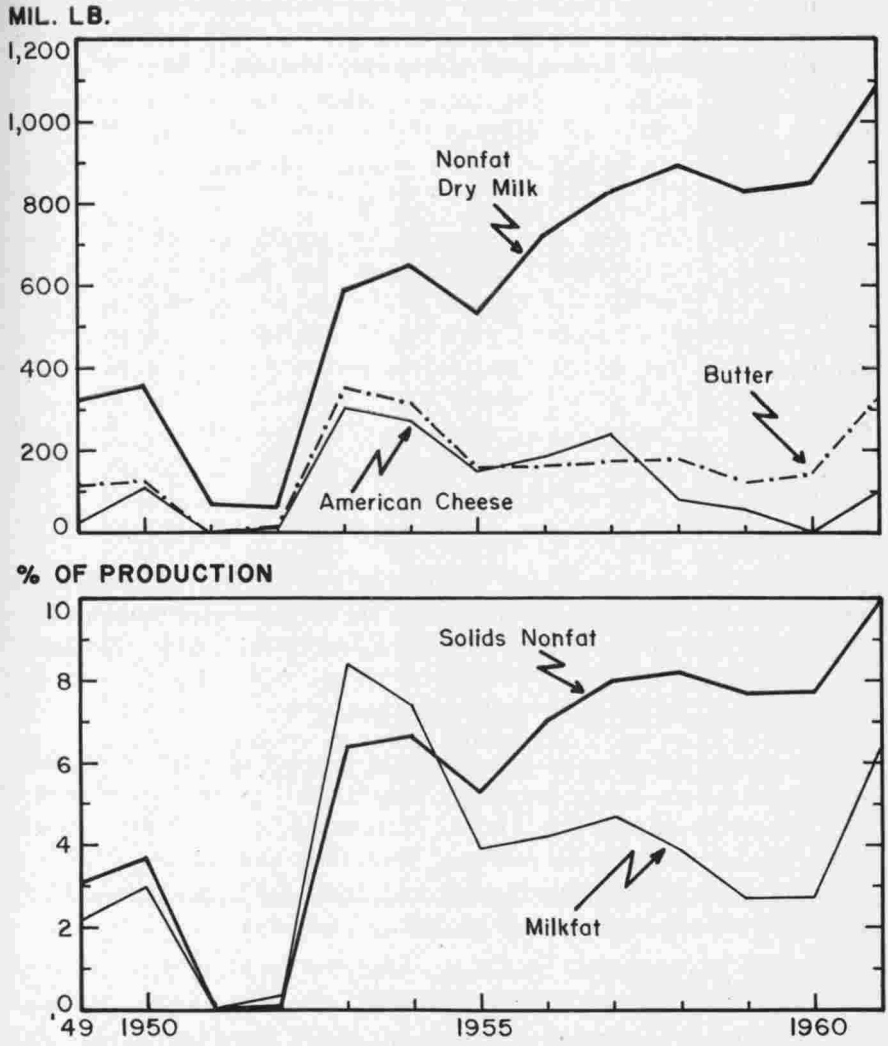


Figure 13. Purchases of Dairy Products by the United States Department of Agriculture for Price Support and Related Programs 1949-61.[a]

[a] Source: DS.-288, U. S. Department of Agriculture, February, 1962, p. 31.

The per capita consumption rates for individual items and for aggregate milk usage varies greatly by geographic area. Table 2 compares per capita consumption rates for all fluid milk products in five Tennessee markets and in four selected Eastern and Midwestern markets. All of the Tennessee markets were below Boston or Chicago in per capita consumption of fluid milk from 1956-1961.

Table 2. Per Capita Consumption Rates by Geographic Area, Fluid Milk Equivalent of All Fluid Products Sold, Five Tennessee Markets and Four Selected Eastern and Midwestern Markets, 1956 - 1961 [a]

Market	1956	1957	1958	1959	1960	1961
			Pounds			
Boston, Mass	411	416	405	401	403	398
Philadelphia, Pa.	307	310	282	299	289	279
Chicago, Ill.	378	375	361	353	348	332
St. Louis, Mo.	266	268	264	262	259	252
Appalachian	171	174	180	187	175	176
Chattanooga	—	265	256	258	251	247
Knoxville	288	280	279	287	291	282
Memphis	216	207	203	206	182	176
Nashville	—	—	227	234	214	212

[a] Statistical Bulletin 312, U. S. Department of Agriculture, May, 1962, and "Fluid Milk and Cream Report" Da 1-3 (5-62) U. S. Department of Agriculture, May 17, 1962.

However, Chattanooga and Knoxville compared favorably with Philadelphia and St. Louis. The other three Tennessee markets were extremely low in per capita consumption of fluid milk products.

Government Activity in Milk Marketing

Over-production of milk relative to current effective demand at supported prices led to increased federal government purchases of milk products during the fifties. Purchases by the United States Department of Agriculture from 1953-1961 ranged from 2.7% to 8.4% of the milk-fat production and from 5.3% to 10.0% of the solid-not-fat production [10] (Fig. 13).

Milk Distribution—Tennessee Example

In addition to these general trends there have been many milk distribution changes which have affected the Tennessee dairy industry. The most important changes were: percent of milk used for fluid purposes, type of fluid product sold, container size, and method of distribution.

Figure 14 shows the change in percentage of Class I utilization in five combined Tennessee markets. There has been a large growth in producer deliveries, up 28% since 1958, but a smaller change in total demand, up 21% in the same period.

For fluid milk there have been some changes in type of product sold which may be noted by observing the Memphis market where

[10] **Dairy Situation** DS-288, U. S. Department of Agriculture, February, 1962.

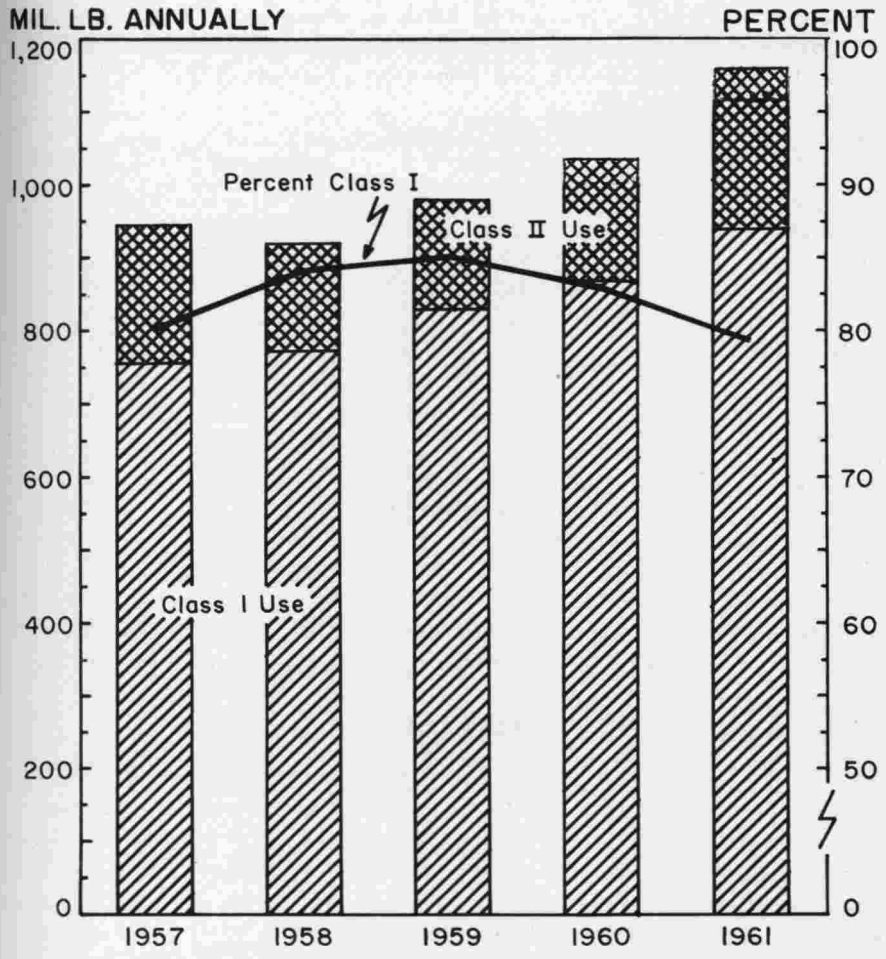


Figure 14. Total producer milk delivered, Class I Utilization and Class I as a percent of producer milk, five Tennessee Federal Order Markets, 1957-61.[a]

[a] Source: Market Administrators' Reports for Appalachian, Chattanooga, Knoxville, Memphis, and Nashville Federal Milk Orders.

data are available since 1943 (Fig. 15). The major product change during this period was the shift from standard or regular cream-separated milk to homogenized milk; there has also been a decline in extra rich or premium milk on this market. Fluid skim milk showed some increase during the late 1950's, while buttermilk use declined substantially as a percent of total fluid milk pounds.

Changes since 1958 are shown for five Tennessee markets combined in the ratio chart in Figure 16. This semi-log chart shows

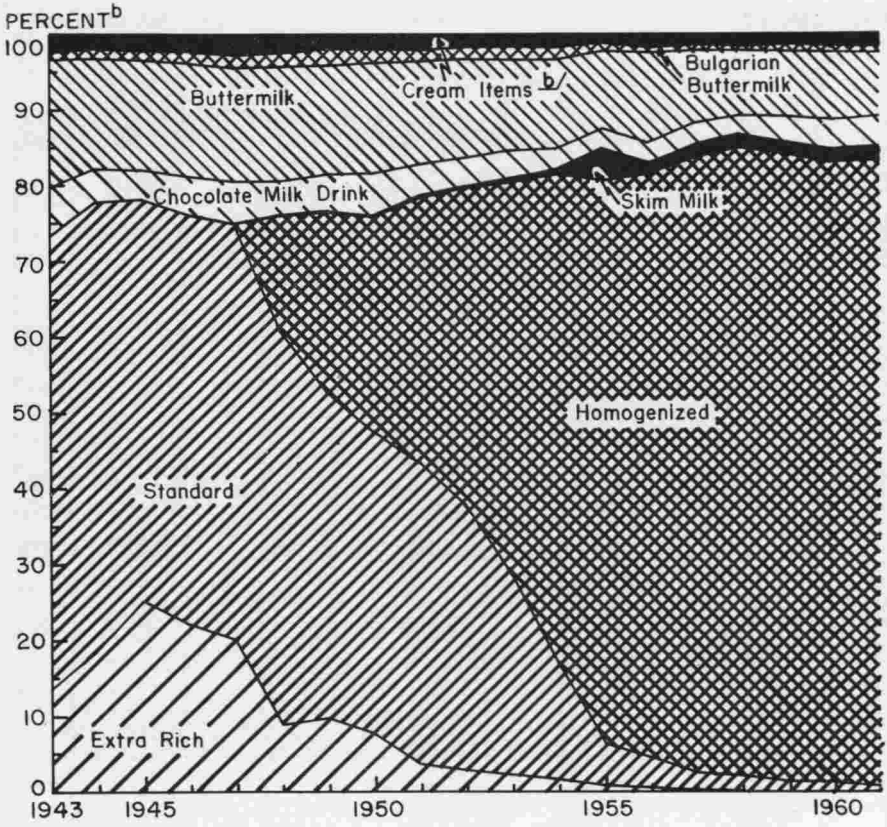


Figure 15. Changes in fluid milk and other Class I Items, Memphis Market, 1943-1961.[a]

[a] Source: Downen. M. L., **Statistical Data for Memphis Milk Market**, 1943-1950; 1951-1961 Data from Market Administrator's Reports. Data after 1957 includes Jackson, Tennessee. Data are for May each year.

[b] Percent of total Class I product pounds.

percentage as well as absolute changes in product utilization. The shaded area indicates change over base line 1958 utilization. The largest percentage change in sales for 1961 over 1958 occurred in skim milk products, except buttermilk. Fluid whole milk and cream items both showed some increase during the 4-year period, but were substantially level during 1960 to 1961. Buttermilk sales actually declined during the 1960 to 1961 period.

Significant changes have taken place in size of containers used to market fluid milk products. Using homogenized milk, the largest volume item, as an example, Figure 17 shows the trend toward

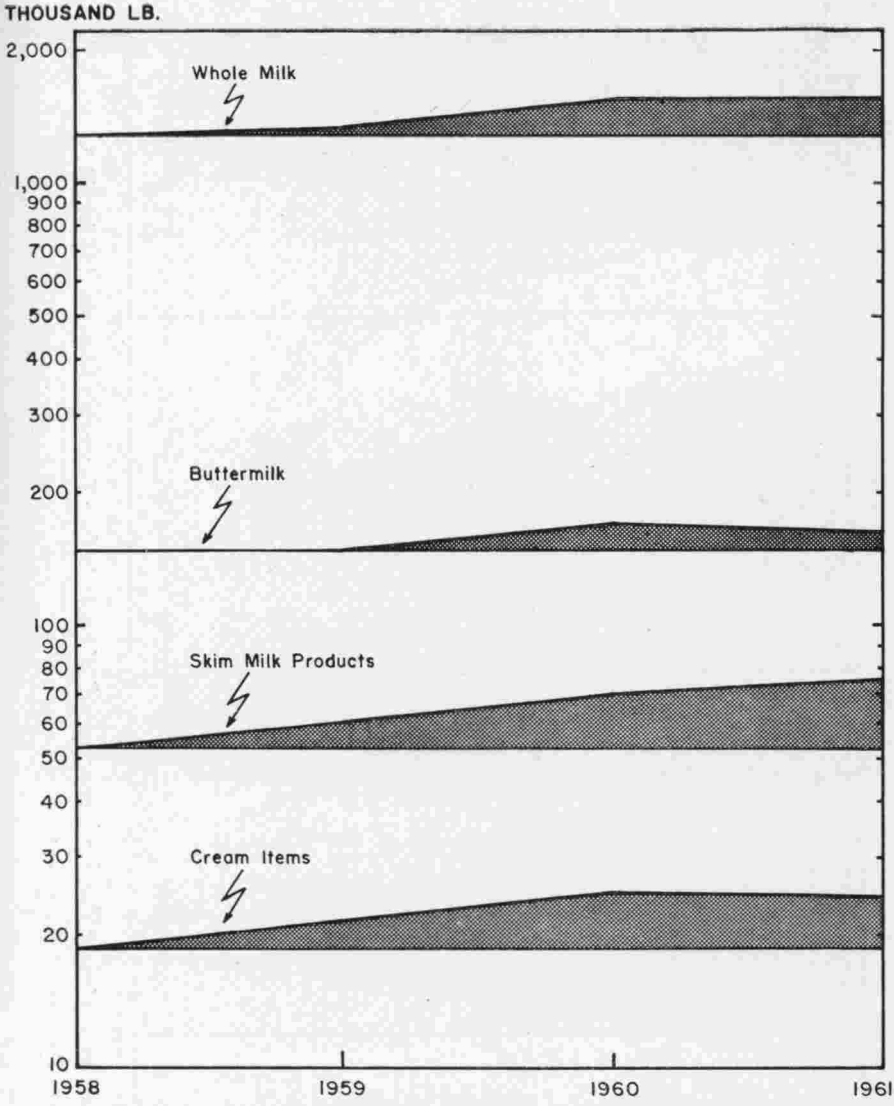


Figure 16. Changes in Class I product utilization, average daily sales, five combined Tennessee Markets, 1958-1961.[a]

[a] Fluid Milk and Cream Report, ERS, USDA, March issue each year. Whole milk includes plain, yogurt, and flavored; skim milk includes flavored, plain, and fortified; cream items include milk and cream mix, eggnog, light, sour, and heavy cream. Tennessee markets include Appalachian, Knoxville, Chattanooga, Nashville, Memphis Federal order areas.

larger-sized containers in each of four Tennessee markets.[11] Sales in gallon or larger containers—including jugs, twin-paks (2 half-gallon paper cartons) and dispensers—amounted to 38% of total

[11] Comparable data for the Appalachian market not available.

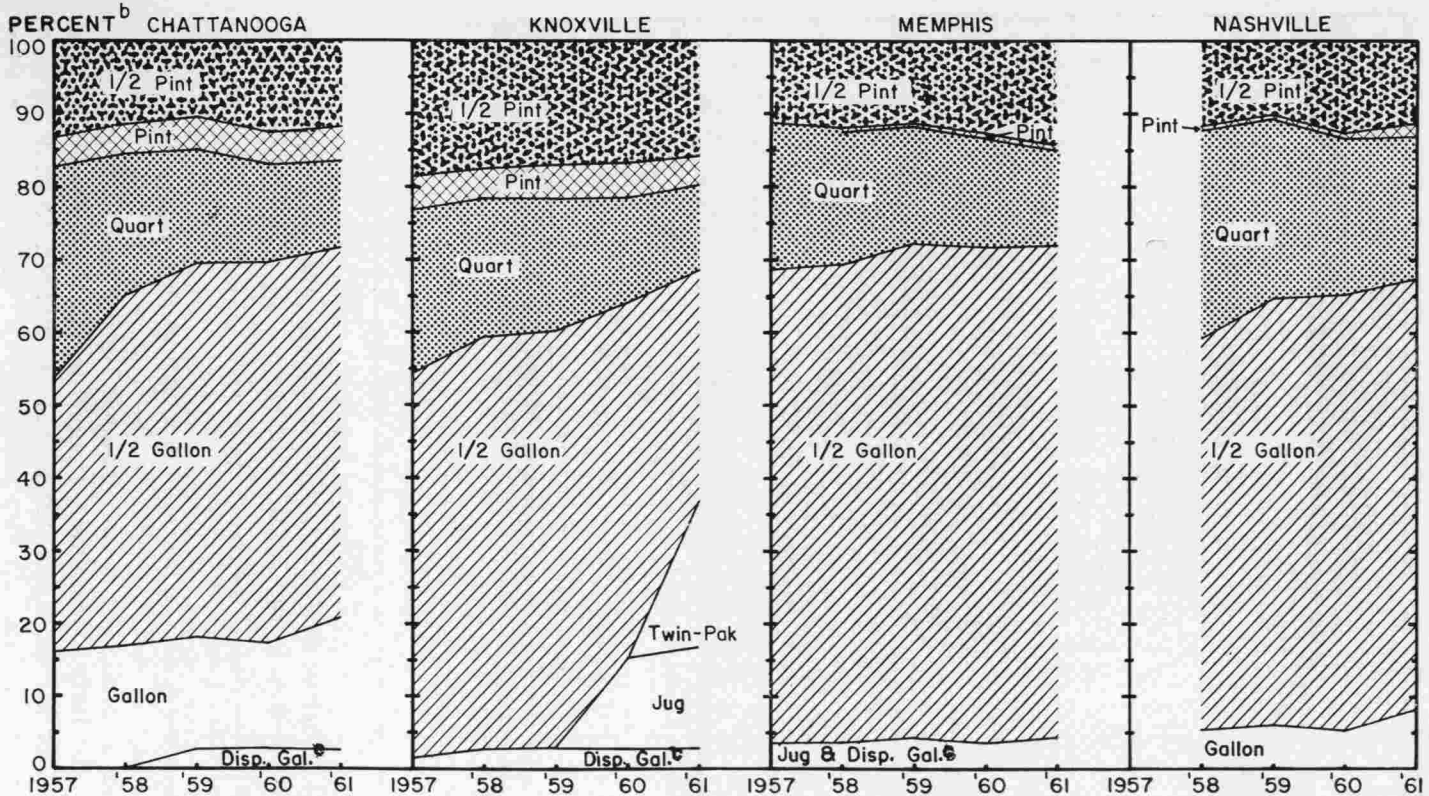


Figure 17. Comparison of container size for homogenized milk sold in four Tennessee Markets, 1957-1961.[a]

[a] Source: Market Administrators reports. Data are for May each year.

[b] Pecent of homogenized milk product pounds.

[c] "Disp. gal." equals dispenser gallon which is largely milk disposed of in 3-5 gallon units for use in milk dispensers.

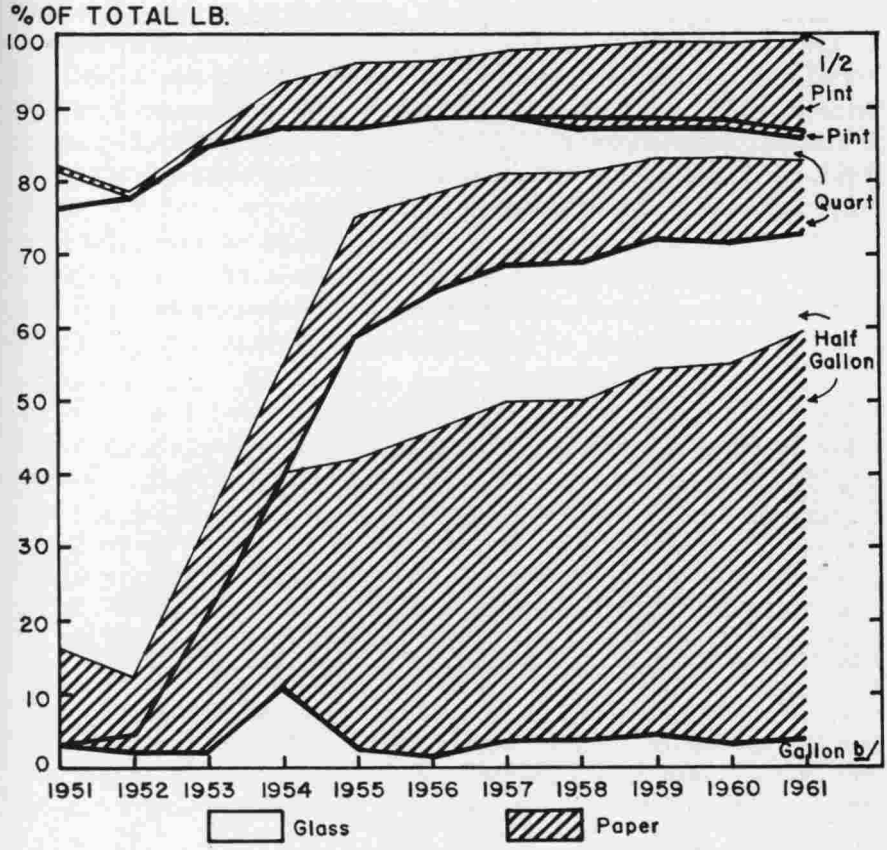


Figure 18. Historical comparison of homogenized milk units by size and glass and paper container utilization, Memphis 1951-61.[a]

[a] Milk Market Administrators Reports.

product pounds in the Knoxville market in 1961. In 1957 only 2% of homogenized product pounds were sold in gallon-size units. Smaller increases were noted in the other three markets for gallon units, but in all markets there has been a shift from the quart unit to half-gallon container.

In Knoxville, data are available which show 54% of the homogenized milk was sold in quarts in 1951 compared with 17% in half-gallon units. By 1957 this had changed to 53% half-gallon and 23% quarts. By 1961 half-gallons dropped to 31% because of the increase in gallon units; however, quarts dropped to only 12% of sales. Historical data are also available for Memphis which show

73% of homogenized milk sales in quart containers in 1951, 20% in 1957, and only 13% in 1961. Half-gallons meanwhile moved from zero in 1951 to 65% of milk sales on a volume basis in 1957 and 68% in 1961. In the Memphis market, sales of homogenized milk in paper accounted for 78% of the total homogenized milk sales in 1961. In 1951, paper containers accounted for only about 14% of total homogenized milk sales (Fig. 18).

There has been a decline in the percentage of fluid milk items sold on home delivery routes, and an increase in wholesale deliveries to stores, restaurants, and institutions. This decline between 1958 and 1961 was noted in all four Tennessee markets analyzed (Table 3).

Table 3. Fluid Milk Product Sales by Wholesale and Retail Outlet, Four Tennessee Markets, 1958 and 1961.[a]

Market	Whole Milk[b]		Skim Milk Items[c]		Buttermilk[d]		Cream Items[e]	
	Retail	Wholesale	Retail	Wholesale	Retail	Wholesale	Retail	Wholesale
	Percent of product pounds							
1958								
Chattanooga	24.3	75.7	24.4	75.6	15.1	84.9	14.3	85.7
Knoxville[f]	33.0	67.0	39.2	60.8	24.4	75.6	18.8	81.2
Memphis	39.1	60.9	17.6	82.4	18.1	81.9	12.6	87.4
Nashville	32.3	67.7	40.7	59.3	24.5	75.5	25.2	74.8
1961								
Chattanooga	19.1	80.9	21.7	78.3	12.6	87.4	8.5	91.5
Knoxville[f]	27.2	72.8	32.8	67.2	18.2	81.8	14.5	85.5
Memphis	18.7	81.3	14.6	85.4	9.2	90.8	10.7	89.3
Nashville	26.8	73.2	33.7	67.3	18.9	81.1	17.0	83.0

[a] Source: Market Administrator's reports: data are for May each year. Comparable data for Appalachian market not available.
[b] Include standard, homogenized, and extra rich.
[c] Includes fluid skim and flavored drinks.
[d] Includes Bulgarian and plain.
[e] Included half and half (cream mixture), light heavy, and sour cream.
[f] Knoxville wholesale includes sales to distributors.

ECONOMIC IMPLICATIONS

Methodological and technological innovations have taken place at a rapid rate in the production, processing, and distribution of milk and milk products. The major trends outlined are expected to continue as follows:

The increase in average dairy farm size, both in terms of acres and in terms of herd size, should continue as commercial dairy

farmers expand their facilities. The output per milk cow in Tennessee, which is below the United States average and far below the average of some Midwestern dairy states, should continue to increase. This increase should be relatively rapid as the number of farms with less than five milk cows continues to decline (Appendix Table 1). These small herds help lower the Tennessee average milk production per cow below that of other states with a larger proportion of commercial herds.

Processing plants are expected to continue to merge and enlarge their processing facilities and areas of distribution.

At the distribution and consumption levels substantial and widespread changes have also occurred in this past decade. Better highways and transportation equipment—along with major container changes—have enabled formerly localized fluid milk products to be distributed over a wide area. The paper container with its reduced weight and space requirements and non-returnable feature has greatly increased milk distribution areas. Recently, plastic-coated containers have replaced the wax-coated paper cartons in many fluid milk markets. All these were changes of the last decade.

Development of new products and new product containers may alter present production and marketing patterns. Many of the variations cited are interrelated. For example, the shift in type and size of container is related to store vs. home delivery and to the size of distribution area. All of these trends will continue to have an important influence on the dairy industry of the United States and of Tennessee.

Dairy producers, processors, and distributors have been quick to adjust to these changes of the decade of the 1950's. There is every reason to believe that they will continue to make needed economic adjustments.

APPENDIX

Table 1. Farms Reporting Milk Cows by Size of Herd, Tennessee, 1950, 1954, and 1959.

Number of cows	Number of farms			Percentage of farms		
	1950[a]	1954[b]	1959[b]	1950[a]	1954[b]	1959[b]
1 or 2	88,884	78,243	47,330	57.7	56.1	53.7
3 or 4	27,377	23,248	15,539	17.8	16.6	17.6
5 - 9	23,689	23,291	13,686	15.4	16.7	15.5
10 - 19	10,428	10,174	7,129	6.8	7.3	8.1
20 - 29	2,063	2,609	2,128	1.3	1.9	2.4
30 - 49	1,121	1,405	1,570	0.7	1.0	1.8
50 - 74	390	326	531	0.3	0.2	0.6
75 - 99		106	133		0.1	0.2
100 and over		79	91		0.1	0.1
Total	153,952	139,481	88,137	100.0	100.0	100.0

[a] Number of farms reporting cows milked the day prior to the survey. Economic Area Table 3, V. 1 p c 20, Census of Agriculture, 1950.

[b] State Table 12, Census of Agriculture, 1959.

Table 2. Number of Farms in Tennessee, Total, All Commercial and Commercial Dairy, by Milk and Cream Sold, 1954 and 1959.[a]

Type of farm	Number of farms		Percent of farms selling milk or cream		Proportion of farms in each type		Proportion of value of all milk and cream sold	
	1954	1959	1954	1959	1954	1959	1954	1959
All farms[b]	203,149	157,688	25.3	24.2	100.0	100.0	100.0	100.0
All commercial[c]	124,468	82,639	34.1	32.0	61.2	52.4	95.4	92.1
Dairy[d]	15,132	9,642	100.0	100.0	7.4	6.1	70.5	70.3

[a] U. S. Census of Agriculture, 1954 and 1959.

[b] All farms: In the 1954 Census of Agriculture places of 3 or more acres were counted as farms if the annual value of agricultural products, whether for home use or for sale, amounted to $150 or more. Places of less than 3 acres were counted as farms only if the annual sales of agricultural products amounted to $150 or more. In 1959, the definition is more restrictive. Places of less than 10 acres were counted as farms only if sales for the year amounted to at least $250. Places of 10 acres or more were counted as farms if the estimated sales of agricultural products for the year amounted to at least $50. For Tennessee the change in total number of farms from 1954 to 1959 due to definition change amounted to 11,613 fewer farms.

[c] The 1954 and 1959 definitions of commercial farm are as follows: in general, for 1954, all farms with a value of sales of farm products amounting to $1,200 or more were classified as commercial. Farms with a value of sales of $250 to $1,199 were classified as commercial only if the farm operator worked off the farm less than 100 days or if the income of the farm operator and members of his family received from nonfarm sources was less than the value of all farm products sold. In general, for 1959, all farms with a value of sales amounting to $2,500 or more were classified as commercial. Farms with a value of sales of $50 to $2,499 were classified as commercial if the farm operator was under 65; worked off the farm less than 100 days during the year and if the income received by the operator and members of his family from nonfarm sources was less than the value of all farm products sold.

[d] In both 1954 and 1959 farms were classified as dairy farms if 50% or more of total sales were from dairy products. Also classified as dairy farms were farms with 30% or more of total sales from dairy products if milk cows represented 50% or more of all cows and sales of dairy products plus sales of cattle and calves amounted to 50% or more of the total value of all farm products sold.

Table 3. Some Selected Characteristics of Commercial Dairy Farms by Economic Class, Tennessee, 1959.[b]

Commercial dairy farms by economic class[a]	Number of farms	Percent dist.	Average size farm	Value of land and building per farm	Milk cows per farm	Total dairy products sold	Percent distribution of dairy sales	Dairy products sales per farm	All farm product sales per farm	Percent dairy is of all farm product sales
	No.	%	Acres	$	No.	$	%	$	$	%
Class I	61	0.6	729.8	203,803	104	2,238,115	5.1	36,690	56,768	64.6
Class II	443	4.6	497.5	87,337	63	8,213,392	18.8	18,540	26,012	71.3
Class III	1,419	14.7	273.2	45,733	38	13,690,993	31.3	9,648	13,450	71.7
Class IV	2,483	25.8	178.5	23,953	23	11,637,825	26.6	4,687	7,053	66.4
Class V	3,225	33.4	135.8	15,250	13	6,445,550	14.8	1,999	3,612	55.3
Class VI	2,011	20.9	79.3	8,101	7	1,468,705	3.4	730	1,496	48.8
Total or average	9,642	100.0	175.6	24,663	21	43,694,580	100.0	4,532	6,870	66.0
All commercial farms	82,639	—	139.1	16,473	7	57,196,634	—	692	4,967	13.9

[a] Economic class of farm depends on value of farm products sold by commercial farms (see definition commercial farm and commercial dairy farm footnote Appendix Table 2).

Class of farm	Value of farm products sold
I	$40,000 and over
II	$20,000 to $39,999
III	$10,000 to $19,999
IV	$ 5,000 to $ 9,999
V	$ 2,500 to $ 4,999
IV	$ 50 to $ 2,499

[b] U. S. Census of Agriculture, 1959.

Table 4. Approximate Labor Use on Commercial Dairy Farms by Economic Class, Tennessee, 1959 [a]

Economic class of farm	Number of farm operators (1)	Hired Labor		Total employed including[b] operator (4)	Number of milk cows (5)	Average number milk cows per worker (6)
		Farms reporting (2)	Persons (3)			
Class I	61	55	250	311	6,373	21
Class II	443	382	930	1,373	27,995	20
Class III	1,419	673	1,009	2,428	53,738	22
Class IV	2,483	481	621	3,104	55,765	18
Class V	3,225	200	265	3,490	42,795	12
Class VI	2,011	15	30	2,041	13,343	6
All commercial dairy farms	9,642	1,806	3,105	12,747	200,009	16

[a] U. S. Census of Agriculture, 1959.

[b] Excludes part-time help working annually 150 days or less and family workers.

Table 5. Dairy Plant Changes in Tennessee 1954 through 1958.[a]

	Number of plants		Percent increase (+) or decrease (—)
	1954	1958	
Creamery butter	3	3	0
Natural cheese	20	19	— 5
Condensed and evaporated milk	13	8	—38
Ice cream and frozen desserts	39	39	0
Special dairy plants	5	3	—40
Total manufacturing	80	72	—10
Fluid milk plants	91	82	—10
Total dairy plants	171	154	—10

[a] U. S. Census of Manufactures, 1954 and 1958 Dairy Products, MC 58(2)—Group 20B, U. S. Department of Commerce, Bureau of Census, 1960.

Table 6. Number of Dairy Farms Reporting Various Selected Items of Equipment, Tennessee, 1950, 1954 and 1959.[a]

Equipment	Number of farms reporting each item			Percent of farms reporting each item		
	1950	1954	1959	1950	1954	1959
Pick-up baler	884	1,734	3,056	6.0	11.5	31.7
Milking machine	3,599	4,859	6,032	24.6	32.3	62.3
Grain combine	1,285	1,919	2,005	8.8	12.7	20.8
Motor trucks	5,016	6,948	6,088	34.3	46.1	63.1
Tractors (other than garden)	5,524	8,414	7,354	37.8	55.9	76.3
Field forage harvester	—	759	1,156	—	5.0	12.0
Electric milk cooler	—	—	6,540	—	—	67.8
Total farms	14,611	15,057	9,642	—	—	—

[a] U. S. Census of Agriculture, 1950, 1954 and 1959.

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